PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

(107725.6)

Applicant:	Geary G. Parke	U.S.S.N:	10/691,297
Filing Date:	4/1/03	Examiner:	Savage, M.
Title:	ADSORPTION SYSTEM	Art Unit:	1724

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Assistant Commissioner for Patents
Washington, DC 20231

Sir:

Declaration of Steven Buday Under 37 CFR §1.132:

1. I hereby declare that all statements made herein are true, and further that the statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2. I have a B.S. from Eastern Michigan University, Ypsilanti, Michigan, with a Majoring in Biology and a Minor Chemistry. I am currently enrolled in the Graduate Chemistry Program at Oakland University, Rochester, Michigan.

3. I have over 7 years experience years working as a water chemist with an emphasis on waste water treatment.

4. I am a Certified Water Technologist as recognized by the Association of Water Technologies. I also hold a Certificate in the Treatment of Metal Wastestreams from

California State University at Sacramento CA.

5. I currently serve as Technical Manager of Plymouth Technology, Inc., assignee of the present invention disclosed in U.S. Patent Application 10/691,297.

6. I have read and I understand U.S. Patent Application 10/691,297, as well as the Office Actions and the cited references.

7. Claim 7, as amended, recites a first trap which filters solids from wastewater and comprises one of charcoal and coal, and a second trap which adsorbs organic materials and metals from the wastewater and at least partially comprises a phosphate. A first chamber contains the first trap and a second chamber contains the second trap, and each chamber is separated from the other chambers by at least one valve and the flow of wastewater is sequential from the first chamber to the second chamber. Claims 8, 9, 10 and 12 (as amended) all depend from claim 7.

8. Claim 21, as amended, recites a first media filters solids from wastewater and comprises one of charcoal and coal, and a second media which adsorbs organic materials and metals from the wastewater and at least partially comprises a phosphate. A first chamber contains the first trap and a second chamber contains the second trap. The media in the first chamber is different from the media in the second chamber. Claim 11 depends from claim 21.

9. Sequential flow and separation of different media into separate chambers are both significant advantages of the technology disclosed in the Application.

10. I am familiar with mixed media filtration systems like those disclosed in Fig. 7 of U.S. Patent 5,427,683 to Gershon et al. where clays of various compositions

are mixed with charcoal particles. It is my experience that mixing medias in that manner results in poor removal of contaminants.

11. For example, Table 1 discloses a comparison of a mixed media of clay media and a charcoal media used with industrial wastewater runoff from aluminum die caster. In ID 1, the two media are mixed together. In ID 2, the same two media are placed sequentially in separate chambers. Advantageously, sequential flow greatly reduces the amount of pollutant (here, FOG – Fatty Oils and Greases) even when an identical volume of media are used in each configuration.

12. Table 1. Comparison of FOG removal results from mixed media with effluent of sequential media.

ID	Media Configuration	Raw FOG mg/L	Effluent FOG mg/L
1	Mixed Media	600	340
2	Sequential	600	260

13. Although the data in Table 1 only shows FOG effluent reduction, other pollutants may be removed at higher rates. That is, by eliminating much of the organic loading in a first chamber with a first media, sequential flow through separate media chambers reduces fouling of other pollutant reducing media, such as, for example, a metal removing media. The net effect is that both pollutants (metals and organics such as FOG) are removed at a higher rate.

14. Table 2 represents data from an electrolyte coating shop concerned with removing phosphate from industrial wastewater. The same mixed media are used as in Table 1. As before, the mixed media did not remove as much pollutant (here, phosphates) when compared to the sequential alignment. By removing contaminants sequentially, the media selection can advantageously be tailored to the contaminant present. The media will also be less likely to foul, i.e., become unable to adsorb additional pollutants. As with Table 1, both configurations used an identical volume of media.

15. Table 2. Comparison of phosphate effluent results from mixed media with phosphate effluent of sequential media.

ID	Media Configuration	Phosphate mg/L	Phosphate mg/L
1	Mixed Media	115	60.6
2	Sequential	115	36

16. Mixed media will also be more likely to suffer from cross contamination from the other media present in the chamber. For example, a strongly cationic clay media can react with a positively charged carbon media and reduce overall removal capacity.

17. Another major disadvantage to mixing media is that all media must be replaced when only one media is exhausted. In the example noted in paragraph 16, the clay media will likely be exhausted before the carbon media, given normal use. If in separate vessels, the clay can be removed while leaving the other

media behind. In the above die caster example (Table 1), all media would reach exhaustion in approximately one month. By separating the vessels, only the clay will need to be replaced (re-bedded) on a monthly basis. The metals removal media will last up to 4 months. This will reduce overall media cost and disposal quantity as shown in Table 3.

18. Table 3. Media Rebed Quantity Comparison.

Media Configuration	Rebed Frequency Stage 1	Stage 2	Pounds per Rebed Stage 1	Stage 2	Total Annual Pounds of Media
Mixed	12	12	1175	1175	28,200
Sequential	12	3	1300	1050	18,750
Media Consumption Reduction resulting from Sequential Configuration					**9,450 (44% savings)**

19. Furthermore, even when the same media is used in two vessels, there is still an advantage to use separate chambers. The first vessel acts as a rough removal of a pollutant, with the next vessel acting as a fine polish. Table 4 documents field data taken from an E-coat waste stream where the primary contaminant of concern is nickel. The media used in both chambers is a media containing charcoal.

20. Table 4. Field data documenting nickel removal.

Nickel Raw mg/L	Nickel Effluent Stage 2 mg/L	Nickel Effluent Stage 3 mg/L
12.9	2.38	0 142

21. By using two chambers of the same media sequentially, the first media in the first chamber will reach capacity sooner as it is removing 10.52mg/L (12.9-

2.38). The media in the second chamber will likely have remaining available capacity to remove contaminants as it is only removing 2.24mg/L of nickel (2.38-.142). Also, the media in the second chamber will last about 4.70 times as long as the media in the first chamber. By only removing the exhausted media, overall media consumption cost and disposal will be reduced.

22 In summary, sequential flow is advantageous because it allows for larger amounts of pollutants to be removed with less media used and with less cross contamination. Sequential flow also allows for greater removal of a pollutant even when the same media is used.

Respectfully Submitted,

Steven Buday

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